SIEMENS

MULTIMOBIL 10

SP

Troubleshooting Guide

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Multimobil 10

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Service Instructions
Version: 4.0

INDEX

1 Service

1.1 Safety Precautions :

Before working on the unit ensure that the Mains is switched OFF.
For completely safe working remove mains plug.

The unit must be OFF before removing or putting back the assemblies.
The protective earthing of subassemblies must not be removed in any case.

1.2 Troubleshooting :

1.2.1 Tools and measuring instruments required

- Usual service tools
- Digital Multimeter:
- 2 channel storage oscilloscope with 2 probes and one current probe.
- mAs meter
- Protective ground wire and leakage current tester: Bender safety tester
- Radiation detector

During Oscilloscope operation the protective ground wire connection in the power cable must not be interrupted under any circumstances.
For measurements where ground loops that may be present could impair the measuring result, use the Tek amplifier and the trigger attachment.

1.3 Measuring with oscilloscope :

For normal working, the protective earthing of mains must not be removed.
In case system noise is getting coupled to the scope, use the scope in differential mode.
To measure high voltage, use DIFFERENTIAL probe isolated from ground.

1.4 Handling precautions

Strictly observe ESD precautions while handling PCBs and ESD sensitive devices.

After the unit is switched ON, the capacitors C1~C12 on D970A and D971 charge to 355V DC. After switching the unit OFF, it takes about 08 minutes for capacitors to discharge. The presence of DC voltage is indicated by Green LED V24 on D950A and also V1 ~ V12 LED's on D970A / D971.

1.5 Control Voltages

Voltage	Measuring Point	Range
+5 V	D915. X15.4	4.8v to 5.2v
+15 V	D915. X15.5	13.5v to 16.5v
-15 V	D915. X15.7	-13.5v to -16.5v
Collimator Supply	D801 . X6	12V ac to 16V ac

1.6 Signals & Line voltage display:

Signal	Measuring Point	Range	Adjustment
kVsoll	D915.TP.KVS during Exposure	2.0 ± 0.1 V for 60kV	D915.P7
mAsoll	D915.TP.JRS during Exposure	3.2 V ± 0.1 V for 160mA	D915.P6
IH	D915.TP. IH during Standby	1.5V± 0.1V	D915.P5
	D915.TP. IH during Preparation	2V ±0.3V (for critically damped mA)	
REG: Max Main Inv. req.	D915.TP.REG point during exposure	15 kHz ± 0.5 kHz	D915.P4
CAL :Max Fil.Inv. Freq	D915 TP CAL during start up	15KHz ± 0.5 kHz	D915 .P3

The actual mains Line voltage, at 110 and 230 V supply, is being monitored for display on the 7 segment display during first step of hand release switch for radiography. Ensure that display value mathes with actual line voltage with allowed tolerance ± 5 %. Using **P1 potetiometer** on D801 PCB, set the voltage accordingly.

This is applicalbe while replacing D915 and D801 PCB also.

If the Line voltage is less than 205 volts on on 230 V line, microcontroller switches “ON“ the ’LN’ contactor which will support extra voltage through auto transformer for rotating anode to run at higher speed. In preperation and exposure mode contactor retains its position. After 5 second of each termination of radiography Line voltage is being monitored once again.

When unit is connected to 110 V line LN contactor does not function even though there is a variation in the supply voltage.

1.7 HT Check :

Presence of High Tension
Observe Safety Precautions.

Use radiation protection

1.8 Exposure :

Switch the generator ON.
Set exposure parameters as 60Kv, 16 mAs.
Pull the recoilable exposure release switch and release an exposure.
The yellow LED on top panel lights up for a short duration equal to exposure time.
Audible indication by a Buzzer from the control and muffled sound from inverter confirms the working of the inverter.
The LED's on D915 light in the following sequence:
S27 - STEP 1(half press) : V22
Exposure state : V23
In case of code : V24
Code corresponding to the code is displayed on the seven-segment display.
Sharps knocking sound from inverter indicates inverter short circuit, resulting in code display on the top panel.

1.9 Timing :

Set 60 kV 16mAs
Release an exposure. The radiation indication LED will light for 100msec ± 5msec.

1.10 KVp,KVn &KV Measurement :

The kVp, KVn & KV measurement can be carried out either by kVp-meter or by electrical measurement.

1.10.1 kVp-meter :

Switch the unit ON.
Insert the kV sensor into collimator channel and connect the cable to the meter.
Open collimator flaps such that the sensor is well covered by the field.
Set the kVp meter at 12pulse and 55-85kV ranges.
Set exposure parameters as 60kV 20mAs.
Release an exposure. The radiation LED will light up during exposure.
The meter will read 57-63kV.
Repeat with meter setting 77-150kV and exposure parameter setting, as 90kV 20mAs.The meter will read 85.5-94.5 kV.

1.10.2 Electrical :

Connect oscilloscope at D915.TP.kV.
Set the exposure parameters as 60kV 16mAs.
Release an exposure.
The recorded waveform will read 2.9V - 3.1V.
Repeat with 100kV 10mAs.
The recorded waveform will read 5V +/-0.25V.

Lower kV indicates code in kVsoll / kV sensing / kV-regulator OR high mA.
Higher kV indicates code in kVsoll / kV sensing / kV regulator.

1.11 mA/mAs Measurement :

mAs measurement could be carried out either by mAs-meter or by electrical measurement.

1.11.1 mAs-meter :

Remove mAs link on D800 PCB on the Single tank.
Insert mAs-meter leads in the banana sockets mA+ and mA- on D800.
Set meter at, 200mAs and in the mAs mode.
Set exposure parameters as 60kV 32mAs.
Release an exposure.
The meter will read 31 – 33 mAs.
Repeat for exposure parameters 100kV 40mAs.
The meter will read 39 to 41mAs.

1.11.2 Electrical :

Connect oscilloscope at D915.TP.JR.
Set exposure parameters 60kV 16mAs.
Release an exposure.
The recorded waveform will read 3 – 3. 2V.
The exposure time will be 95 - 105mS.

Lower mA indicates code in mAsoll / mA sensing / mA regulator circuit.
Higher mA indicates code in mAsoll / mA sensing / mA regulator or Low kV.
Incorrect mAs indicate code in timer circuitry.

1.12 Calibration :

It is advisable to re-calibrate the unit in case of undershoot or overshoot observed in the mA wave shape.
Recalibration is required when the single tank is replaced.

1.13 Forming :

If the unit is being installed after six months from the date of despatch, the capacitors C1~C12 on D970A/D971 need forming. Refer Installation instructions for forming procedure.

1.14 Safety notes and protective measures

Refer to the General safety note in Chapter on Installation.

Before working on the open MULTIMOBIL 10, switch off the unit with the power switch at the control panel, the MCB in off position and remove the Mains cable from socket.
Before inserting or removing PC boards, switch off the generator and observe the ESD regulations.

1.15 Replacing damaged or missing screws

Damaged or missing screws should only be replaced by steel screws having the specified tensile strength with Nickel Plating (6492) specified in the Surface Finish Documents.

1.16 Cleaning

The unit must always be switched OFF or disconnected before cleaning.
Use only water or a Luke warm mixture of a household cleaner diluted with water to clean the unit.
Do not use an abrasive or organic solvents or cleaning agents containing solvents such as gasoline used for cleaning purposes, alcohol or stain remover. Do not spray water on the unit.

1.17 Cleaning the Unit

Switch OFF the system prior to cleaning, disinfecting or sterilizing.

Clean the stand with a damp cloth or cotton pad.
Dampen the cloth or pad with water or lukewarm, diluted commercially available liquid cleaning solution.
Note:
Do not use scouring powder; organic solvents (may damage materials) or solvent based cleaning fluids (benzene, alcohol, spot remove).

Do not spray any fluid on the unit. The cleaning fluid must not seep into the generator.

1.18 Disinfecting

As is commonly known, the ingredients in disinfectants are hazardous to your health. Ensure that the room is well ventilated when using any disinfectant. Follow manufacturer's instructions for the use of the product.

To disinfect surfaces, we recommend common liquid solutions of aldehyde-based or ampholytic surfactant -based disinfectant.

Substituted phenol based or chlorine-releasing disinfectant can weaken materials and are not recommended. The same restrictions apply to undiluted solutions with a high alcohol content (e.g. for disinfecting hands). Disinfectant sprays should generally not be used, the spray can seep into the system, and safety features can no longer be guaranteed (possible damage to electrical components, formation off flammable mixtures of air and the solution vapor.

1.19 Maintenance

All parts, modules of this product must be tested, inspected, for performance and safety aspects every 12 months to ensure that the product functions properly and is safe for patients, operating personnel and other persons.
Every 12 months, trained technical personnel should inspect and if necessary replace system components of the generator, which may produce hazardous, conditions due to excessive wear and tear. These instructions should be included in the annual maintenance performed by Siemens Customer Service.

If more frequent inspections and maintenance are required by federal or local regulations, ensure compliance with them.

1.20 Product Disposal

Legal regulations may contain special prescriptions concerning the disposal of this product. In order to avoid environmental damage and/or personal injury, please inform SIEMENS Customer Service if you want to put the unit out of operation and dispose it.

Radioprotection Material

Lead in X-ray tube assembly and in Collimator 3 kg.

Transformer Oil
Oil in X-ray tube assembly, approx. 7 kg.

Plastics
Epoxy resin on PC boards, PVC of cables approx. 10 kg.

Electrolytic Capacitors
These capacitors must be emptied. Please inform the Siemens Customer Service.
Capacitors approx. 15 kg
Remaining Electrolytic Capacitors approx. 0.5 kg.

1.21 Safety Checks

The user shall follow the following safety checks:

1.21.1 Daily checks

Check the power cord. Do not use the unit if the power cord is damaged.

Check the exposure indicator and audible signal during exposure.

Check that the Single tank assembly and the arm system remain in the desired position.

1.21.2 Monthly checks

Check the lifting and lowering movements of the support arm.

Check function of locking lever and cap screw on the X-ray tube

Check the legibility of the labels according to those in section *Location of Labels*.
If any labels require to be replaced, please notify Siemens customer service.

1.21.3 Performance Check (Every Six months)

Check counterbalancing of the support arm at each position.

Check the locking mechanism for the support arm.

Check brake for proper functioning .

Take a sample exposure at 60 kV, 16 mAs.

Check for Radiation indication LED and the Audio indication in form of Buzzer.

Note : Annual Maintenance must be performed as per the guidelines described in the Maintenance section.
Notify Siemens Customer Service if you do not have a maintenance contract.

1.22 Program Modes for servicing.

To put the unit into service mode, Short the ST link on the D915 and put ON the unit.Use the Kv+ and Kv- switches to select the required program from 1 to 7.

To check the parameters in the program,press the DL-serv switch once.

1.22.1 Program 1 : To display the DC voltage on the capacitor.

Select the program one in service mode and the display will read as below

Pr	1

Press the switch DL-serv on the D936 once.

The display will read as below

Cap	XXX

XXX corresponds to the DC voltage on the capacitors.

1.22.2 Program 2 : To check the total number of exposures taken .

Select the program two in service mode and the display will read as below

Pr	2

Press the DL-serv switch and enter into the program.The display will be

XXX	XXX

XXX corresponds to the total number of exposures taken on the unit.

1.22.3 Program 3 : To check the type of codes that occurred in the unit maximum 20 .

Select the program three in service mode and the display will read as below

Pr	3

Press the switch DL-serv on the D936 once.The display will read as below.

AA	XX

AA displays the serial no of the errors occurred in chronological order.
XX corresponds to the type of code.

Press the kV+ switch to check all the codes stored. Maximum 20 codes can be stored.

1.22.4 Program 4 : To Erase the errors that have occurred on the unit.

Select the program four in service mode and the display will read as below

Pr	4

Press the switch DL-serv on the D936 once.The display will read as below.

Era	Err

To erase the errors keep the mAs + switch pressed till the display reads

0	Err

1.22.5 Program 5 : To set the display value at switch ON to Default Kv mAs combination or last selected Kv mAs combination.

Select the program five in service mode and the display will read as below

Pr	5

Press the switch DL-serv on the D936 once.The display will read as below.

las	Val

The default value can be set by selecting the desired kV, mAs combination.
Last selected combination can be stored by pressing the DL-serv switch twice.

1.22.6 Program 6 : To set the maximum kV and mAs value for the unit.

Select the program six in service mode and the display will read as below

Pr	6

Press the switch DL-serv on the D936 once.The display will read as below.

125	100

Set the required limit for kV and mAs using the kV /mAs increment and decrement switches.

1.22.7 Program 7 : To set the max.inverter firing frequency(REG).

Select the program seven in service mode and the display will read as below

Pr	7

On activation of this program by pressing the DL-serv switch , the display indicates

Adj	F

Press the Radiographic exposure switch and monitor REG on Digital storage Oscilloscope.

The display indicates

F	On

Adjust REG for 15 kHz ±0.5kHz by using P4 on D915 card.

2 Codes

	Initialisation Codes	
90	EPROM Checksum Failure	The EPROM Checksum is stored at 7FFEh and 7FFFh as a 16 bit word. During self Diagnostics the software calculates the checksum of the EPROM and compares with the stored checksum.
96	KVsoll Failure	During Self Diagnostics the software outputs 7Fh to the D/A converter (B). The 2.5V at the output of the D/A converter is Read by the µC through Analog Port 4. The value read should be greater than 7Ah and less than 86h. (I.e. between 2.39V and 2.62V)
97	JRS Failure	During Self Diagnostics the software outputs 7Fh to the D/A converter (A). The 2.5V at the output of the D/A converter is Read by the µC through Analog Port 3. The value read should be greater than 7Ah and less than 86h. (I.e. between 2.39V and 2.62V)
99	Last Reset by Watchdog Timer	The built-in Watchdog timer (WDT) is reset by the software every 25 mSec. If due to some failure the software doesn't reset the WDT, the WDT in turn will reset the µC after 65 mSec
	Standby Codes	
02	+15V Supply Code	The +15V supply from SMPS is polled by the µC through Analog port 0. The +15V supply should be between +12V to +18V.
03	Iheiz < Istby	The Filament Standby current is 3A. Iheiz read by the µC through Analog port 2 should be greater than 2.75A. i.e. 1.35V (Iheiz ratio : 1V = 2A)
04	Iheiz > Istby	The maximum value of Standby current permitted is 3.3 A.
05	KVist <> 0	kVist is read by the µC through Analog port 7. During Standby the value of kVist read should be Zero. (kVist ratio : 1 V = 20kV)
06	JR <> 0	JR is read by the µC through Analog port 1. During Standby the value of JR read should be Zero. (JR ratio : 1 V = 50mA)
33	Main Inverter Short Circuit	If the Main Inverter Driver (Cable) is disconnected this Code gets activated. Also if IGBT Drivers on D960 Card detects Short Circuit of IGBT's this Code gets activated.
34	Filament Inverter Short Circuit	This Code gets activated if IGBT Drivers on D801 Card detects Short Circuit of Filament Inverter IGBT's
07	Rot ≠ 0	The current flowing through both the windings of motor is monitored separately. During standby Rotor should be off.RT1, RT2=0.
08	Braking Failure	After exposure is terminated the Unit returns to Standby state and braking of Rotor is started by allowing a DC current to flow through the KI2.During this state which is for 8 sec after exp, RT1=0 and RT2=1.
01	Err signal on D950A active	Temperature on the heat sink of D950A exceeds it's limit or Voltage exceeds 365v across capacitors C1~C12 or IGBT V24 on D950A is short circuit.
31	No Charging	Voltage on capacitors C1~ C12 does not increase within 3.5sec of CS picking up or it is less than 335 V DC
	Exposure Codes	
10	No Rotation of Rotating Anode	Anode Rotation in the Single Tank is not taking place. This Code is displayed if any one of the RT1and Rt2 signal goes low during preparation.
11	Main Inverter Short Circuit	This Code is displayed, when the drivers of the Main Inverter detect short circuit.
12	KVist > kVmax	The PkV and NKV is monitored for Max.68kV separately. If the actual value of kV is greater than this i.e. if the voltages at J12.8 and J12.10 on D915 cross 4.5V, Code is displayed.
13	Iheiz > Imax OR JR > JRmax	Maximum value of Iheiz above which Code will be displayed is 7 A (3.5V).

		Maximum value of mAist above which Code is displayed is 180mA.
14	KVist < kVsoll	kVist is continuously polled during exposure. The value of kVist should be greater than 85% of kVsoll
15	JR < JRS	JR is continuously polled during exposure. The value of JR should be greater than 50% of JRS.
17	Backup Timer	If regular means of terminating exposure fails and exposure gets terminated by the backup timer.
18	Premature Exposure Termination	Exposure Release Switch is released before the exposure is terminated by the mAs Integrator.
21	I > Iheiz	Same as Code 04, but during Exposure.
22	Maximum Preparation Time	This Code is displayed if First step is pressed for more than 15 sec.

3 Troubleshooting

In case of Code, perform the following checks.

3.1 Removing the top panel, front cover and X-ray source assembly

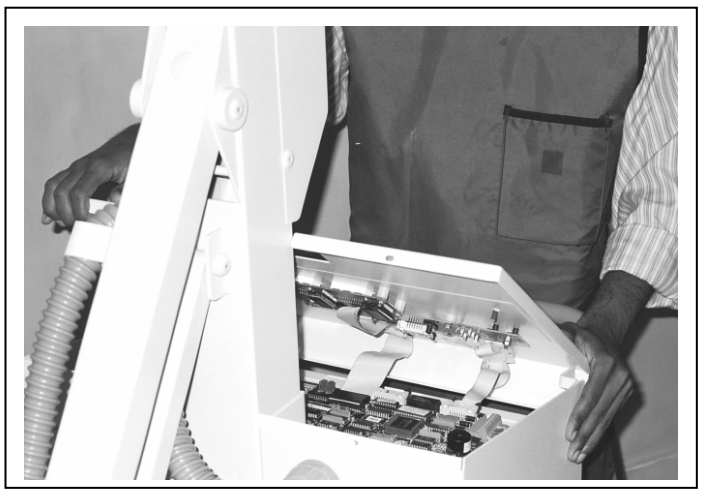
3.1.1 Removing the top panel

Turn off the Multimobil 10,disconnect the mains chord and wind the cord around the cable holder.

Lower the X-ray source assembly to transport position. Lock the Multimobil 10 by applying the brake.

Unscrew the two ornamental screws (see location in figure) with 2.5 mm allen key.

Grasp the top panel and lift it (as shown in figure).



3.1.2 Removing the Front cover.

Turn off the Multimobil 10,disconnect the mains chord and wind the cord around the cable holder.

Lower the X-ray source assembly to transport position. Lock the Multimobil 10 by applying the brake.

Arrange some kind of soft bedding to place the front cover on .

Unscrew the four ornamental screws with 2.5mm allen key.

Grasp the cassette box and slowly pull it outside.

Place the front cover on a soft bedding.

3.1.3 Removing the X-ray source assembly.

Turn off the Multimobil 10,disconnect the mains chord and wind the cord around the cable holder.

Lower the X-ray source assembly to transport position. Lock the Multimobil 10 by applying the brake.

Make sure that the X-ray source assembly is properly secured with the transport safety lock. It should not be possible to move the X-ray source assembly upwards.This is very important for safety reasons.

Tighten the clamping knob.

Rotate the X-ray source aassembly so that the collimator points towards the floor.

Loosen the two Socket head Screws with a 8mm allen key three to four turns for each screw.

Loosen the other four Socket head Screws with a 5mm allen key as shown in the above figure.

Grab the handles and remove the X-ray source assembly. Place it on a soft bedding with collimator facing upwards.

Do not attach anything other than the X-ray source assembly to the arm system.
Other objects will disengage the transport safety lock, causing the arm system to move unanticipated which can cause both personal injury and damage to the equipment.

3.2 Checking the line voltage, fuses and LEDs

3.2.1 Checking the line voltage

Measure the supply voltage at site using the digital Multimeter.

Ensure that the supply conditions
- Voltage
- Frequency

are within limits as specified in the Technical Specifications for the Unit.

Switch the Unit ON

Note : If the Unit cannot be switched ON
Check Supply at Mains socket.
Check Continuity of mains cable with the Plug pins.
Check Over Current Protective devices U1 & U2.

Switch the Unit OFF.

3.2.2 Checking the fuses

Open the front cover of the control unit.
Loosen the Fuse carrier, which are mounted on the transformer bracket of the control unit and check the continuity of fuse link. If fuse link has responded for overcurrent replace the Fuse Link.

3.2.3 Checking the LEDs on D801

F1	6AT	Filament Inverter supply.
F2	1AT	SMPS supply
F3	2.5AT	Rotating Anode supply .
F4	2.5AT	24V Ac supply for Control ckt.
F5	10AT	Collimator supply
F6	0.8 AT	DC-DC Conv. ckt.
F7	1.6AT	220V AC supply for contactors.

Standby mode
On D801 the following LED's are illuminated

V30	Supply for SMPS
V31	Supply for Filament Inverter.
V32	Supply for Rotating Anode ckt
V35	12V AC Supply for Collimator
V36	+VP supply
V50	24V DC on D801
V23&V24	DC supply for filament inverter

3.3 Checking the Control Voltages

In the standby state of the Unit,measure the voltages DC at X15 connector of D915 PCB.

Pin No.	Signal Name	Input/Output	max. permissible voltage/current
1	Dgnd	Input	0V
2	-nc-	-nc-	-
3	Dgnd	Input	0V
4	DC supply	Input	+ 5V
5	DC supply	Input	+15V
6	Agnd	Input	0V
7	DC supply	Input	-15V

- nc - = No Connection

3.4 Checking the Intermediate circuit voltage

Measure the voltage on the D970A or D971 PCB across the capacitor using the digital Multimeter. It should be 355 V dc (+ 10 V / - 5 V dc).

3.5 Checking the maximum main inverter frequency

Turn the Unit OFF.
Place the ST Link on D915 so as to short the two terminals.
Connect oscilloscope on D915.TP.REG and D915.TP.GND.
Turn Unit ON. The unit is now in the Service mode.
In the Service Mode of the unit, select the Prog 7.
On activation of this mode by pressing the DL Service Switch on D936, the radiographic display indicates

AdJ F

Press the Radiographic Exposure switch and monitor **REG** on the oscilloscope.
The display indicates

F On

No Radiation.

F max= 15 ± 0.5 kHz.
Adjust the maximum main inverter frequency with potentiometer P4 on D915
Turn the Unit OFF. Remove ST link.

3.6 Filament current measurement

Turn the Unit OFF.
Connect oscilloscope to D915.TP.IH
Turn the Unit ON.
After approx. 3 seconds the Stand-by filament current starts & equal to 1.5V ± 0.2V
Trigger exposure with default values for kV and mAs.
Observe the change in voltage level from 1.5 V ± 0.2V to Preheat value approx.2.0V
Note: Preheat value is parameter (kV & mAs) specific. Just observe the change in level on preheating step.

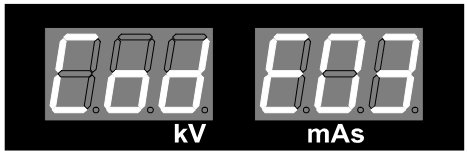
3.7 Checking the high voltage kVsoll and kVist

Connect oscilloscope to D915.TP.KVS & D915.TP.KV
Turn the unit ON.
Trigger an exposure with the default values.

Observe the voltage on C.R.O with the scale corresponding to 1V= 30kVfor KVS and 1V=20KV for KV.

3.8 Setting the Maximum filament frequency

Turn the Unit OFF.
Remove the cable Connector X11 ON D915.
Connect oscilloscope to D915.TP.CAL
Turn the unit ON
The display indicates



Using P3, set the maximum filament frequency on D915 (15 kHz ± 0.5kHz)
Note: Duty Cycle of the waveform is varying as the ON time is fixed.
Connect X11 on D915.

3.9 Checking the tube current

Connect oscilloscope to D915.TP.JRS & D915.TP.JR
Turn the unit ON.
Trigger an exposure with the default values.
Observe the voltage on CRO (1V = 50mA) & confirm value for selected kV & mAs.

3.10 Checking the kV and tube current (JR)

Connect oscilloscope to D915.TP.KV & D915.TP.JR
Turn the unit ON.
Trigger an exposure with the default values.
Observe the voltage on CRO (1V = 50mA & 1V=20kV) for selected kV & mAs .

3.11 Checking the mAs values

Turn the Unit OFF.
Connect mAs meter to “mAs +/ mAs-” on D800 PCB.
Turn the Unit ON.
Trigger the following exposures:

Setting at control panel	Valid mAs values
60kV,16mAs	15.5–16.5 mAs
60kV,100mAs	96–104 mAs
100kV,50mAs	48–52 mAs

Turn the Unit OFF.
Remove the mAs meter and reinsert the Link on the D800 PCB.

3.12 Adjusting the mAs

Turn the Unit OFF.
Remove the Shorting Link “mAs +/-” on D800 PCB banana sockets.
Connect mAs meter to “mAs +/ mAs-” on D800 PCB.
Turn the unit ON.
Trigger the exposures for default kV & mAs settings.
Observe the mAs meter reading and if it is not within the tolerance (i.e. 10% for mAs <20 mAs and 5% for mAs > 20mAs) of set value adjust the potentiometer P1 on D915 card

3.13 Switching the Collimator Light ON

Switch ON Collimator Lamp. The Halogen lamp will light up and field of light will appear on the target. The lamp will be switched OFF automatically after 30 seconds.

If the collimator lamp is switched ON and OFF several times within a short period, overload protection will automatically switch the light OFF. Cool-down periods are recommended.

3.14 Aligning the light field to the radiation field

3.14.1 Operating sequence

Load a 24 Cm x 30 cm or 10” x12 “ cassette with film and place it on a table or a similar base. Using a tape measure, set a vertical SID of 100cm or 40” to the upper edge of the cassette. Using slide flaps set a format of 18 cm x 24 cm or 8”x 10”.
Switch on the Collimator Lamp and align the cassette. Attach radio-opaque markings to the cassette. Attach a washer as lateral marking. Trigger an exposure and develop the film .
Using a waterproof felt pen, write the following data on the developed film.
- Set SID, Film size, Radiation field size.

3.14.2 Evaluation:

Measure the deviations between light field edges and radiation field edges on all four sides (X1, X2, Y1, Y2) as shown.
Determine the total deviations in the X and Y direction (ignore the +/- signs).
Both, length deviation (ΣY) and width deviation (ΣX) must be less than 1.6 cm.

If the deviation is higher, loosen the 4 screws slightly and move the collimator accordingly. Then, tighten the screws at the collimator again.
Repeat the check and, if necessary, adjust the collimator again until the deviation between the light field and the radiation field is within the tolerance (< 2 cm).
The adjustment can also be achieved with the help of a fluorescent screen.

3.15 Checking and readjusting the counterweight

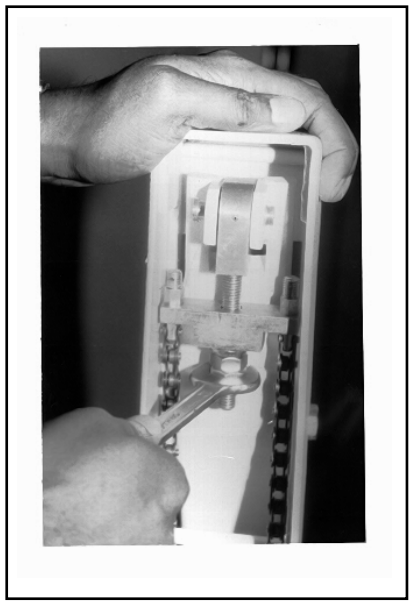
Unlock the support arm and release the turning knob. Without any accessories attached, the support arm should be easy to move across the entire movement range and stop in any position. If the arm is not counterbalancing itself adjustments in the spring tension are required.

Movements:
Check arm counterbalancing at all positions.
It should be easy to lift the arm UP or pull it down.
When the single tank does not remain at the required position, the spring tension should be adjusted for complete balancing. If the Single tank moves DOWN from the required position, the spring tension is to be increased. If it moves UP, then the spring tension is to be reduced.

3.16 Adjustment Instructions :

Carry out the change in the pre-tension of the spring tension as explained below.
Remove the cover from the stand.
Fully release the supplementary brake on the support arm.
Move the support arm into the horizontal position.

Firmly tighten the screw using a 17mm open-ended spanner. Set the spring tension so that the state of equilibrium is obtained when the support arm is in the horizontal position, i.e. that the raising and lowering forces of the tube assembly are the same.



3.17 Replacing the single tank

To replace the single tank, remove it from the mobile stand as follows:
Move the arm system in the lowest (parking) position and check if the **safety locking has engaged.**
The arm cannot be moved upwards any longer.

Tighten the supplementary lock turning the knob.
Detach the collimator from single tank. Also remove the allied connector connected to the single tank bottom cover.
Remove the handle, single tank bottom cover and the single tank top cover.
Disconnect the Single Tank connections from Control by removing snap-on connections and the M5 hex nuts of U, V and Gnd.
Remove the 4 nos. socket head screws M6 X 18 using 5mm Allen key. Loosen the two socket head screws M10 X 35 using the 8mm Allen key.
Lift the single tank off vertically and place it on a soft base.
Install the new single tank in the reverse order.
Check alignment of light field to radiation field and adjust if necessary.

CAUTION The parameter adjustments and the calibration of the Unit is Specific to the Single Tank. In case if the Single Tank is replaced **it is necessary to recalibrate the equipment.**

3.18 Replacing the collimator

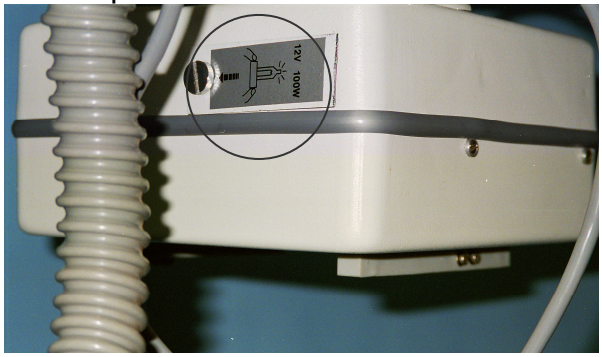
In case of any damage to collimator housing, the collimator has to be replaced completely.
Proceed as described in the following
Loosen the allied connector on the collimator cable and disconnect it from the single tank bottom cover.
Remove the collimator after loosening the four screws.
Attach the new collimator, fasten it with the four screws Connect the allied back.
Follow the light field to radiation field alignment procedure as mentioned above.

3.19 Replacing the Collimator lamp

Loosen the screw of the clamp, which has marked for light indication on the collimator. Take out the defective lamp and replace it by a new lamp.

Caution : Do not touch the glass envelope with your bare fingers.

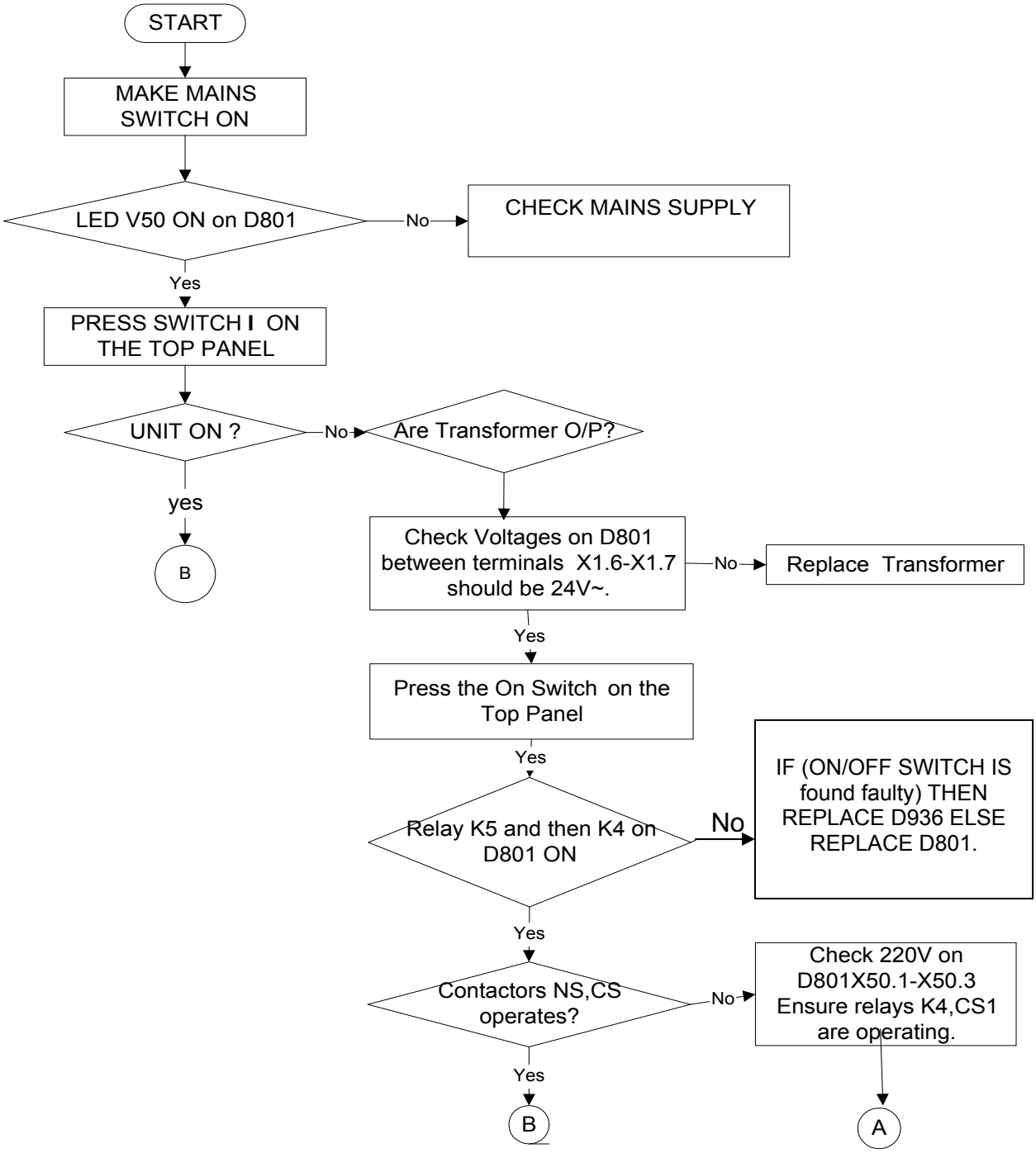
Check functioning of the lamp.

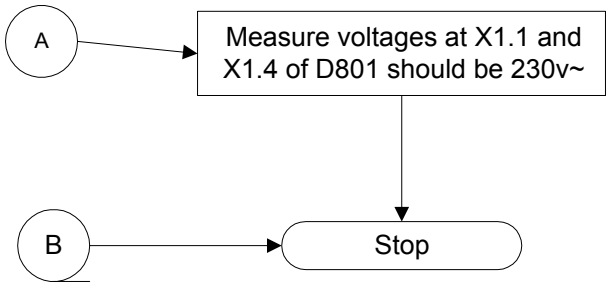


4 Specific Code Handling

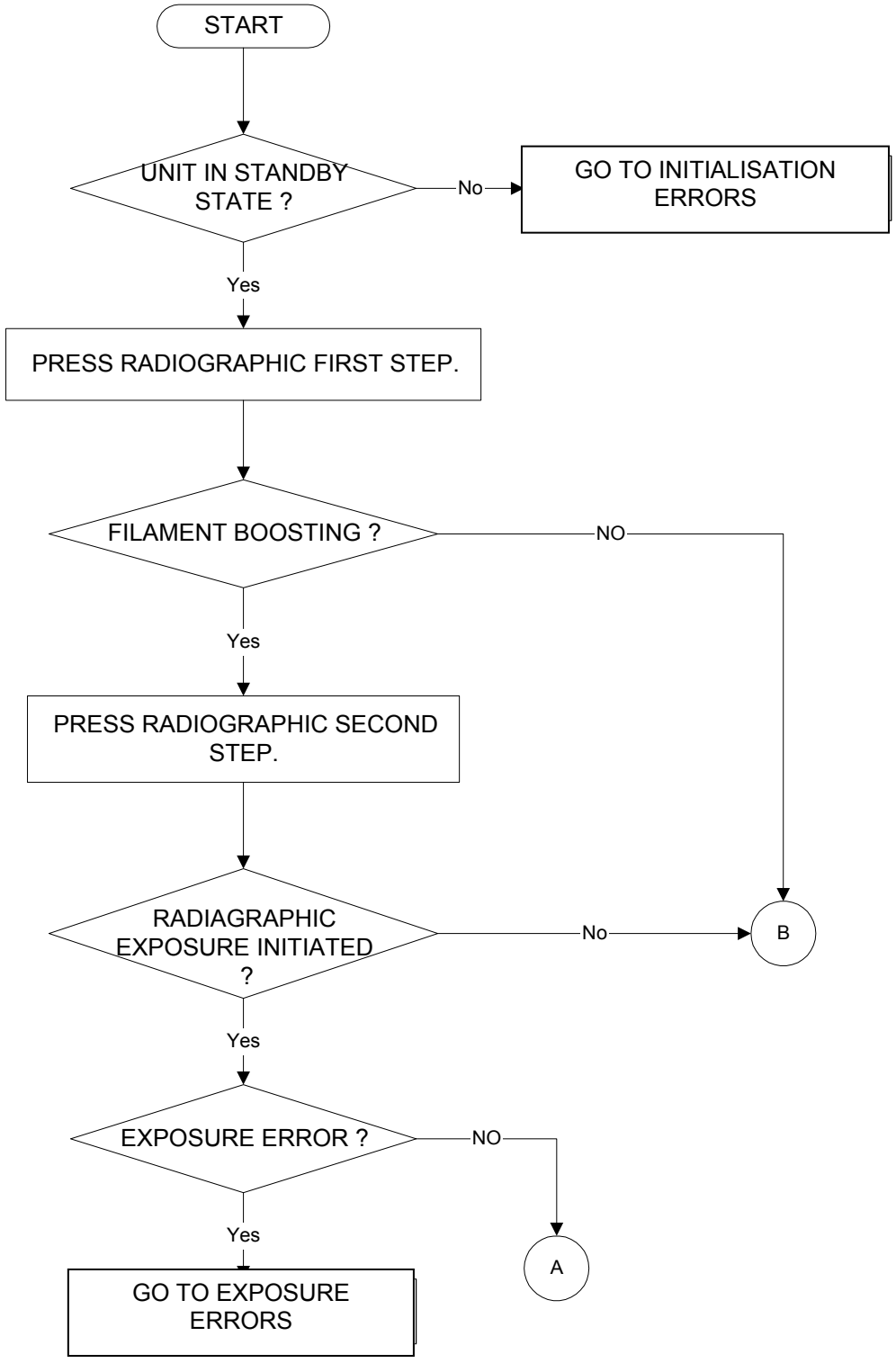
Note :Please Ensure that the Calibration of the unit is done properly before starting with the code Handling.

4.1 Unit not switching ON

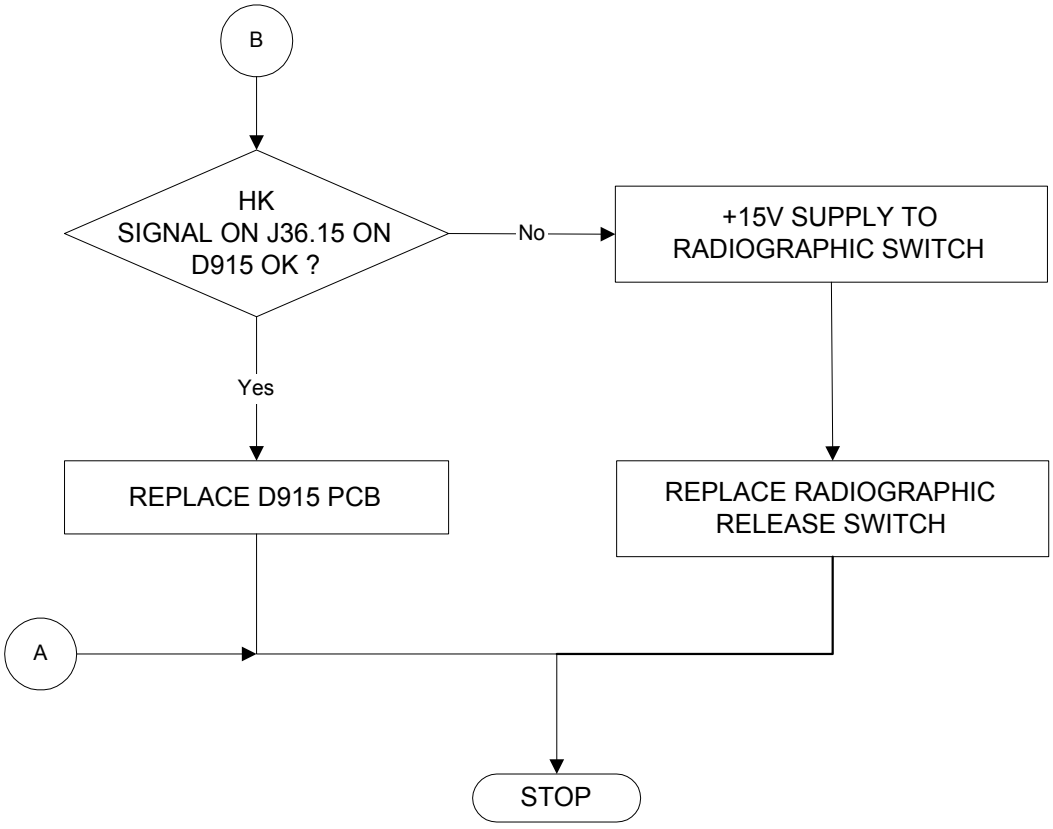



A
Measure voltages at X1.1 and X1.4 of D801 should be 230v~
B
Stop

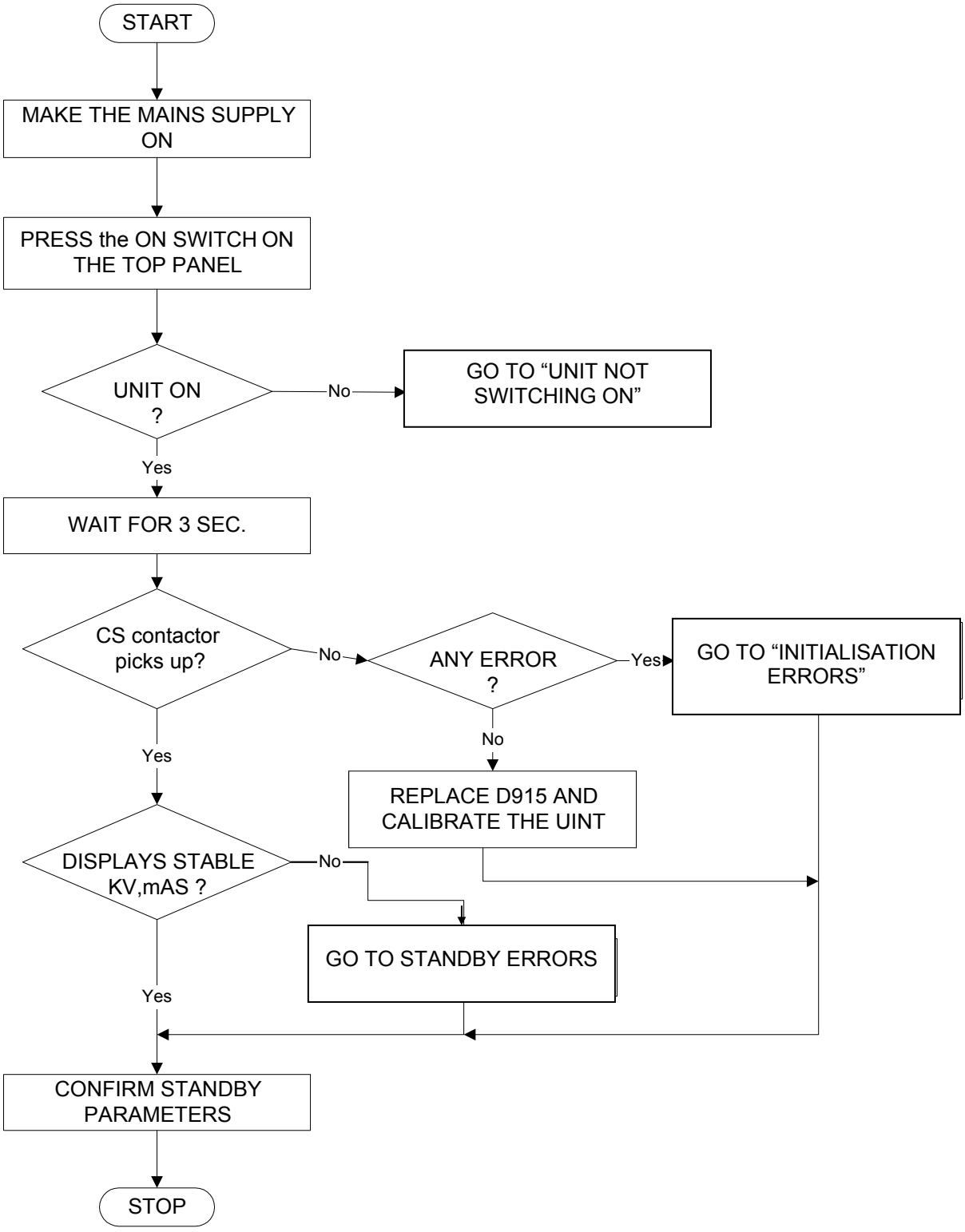
4.2 No Radiography



Contd….


B
HK
SIGNAL ON J36.15 ON
D915 OK ?
No
+15V SUPPLY TO
RADIOGRAPHIC SWITCH
Yes
REPLACE D915 PCB
REPLACE RADIOGRAPHIC
RELEASE SWITCH
A
STOP

4.3 No Standby



4.4 Initialisation codes

4.4.1 Code 90 (EPROM CHECKSUM FAILURE)

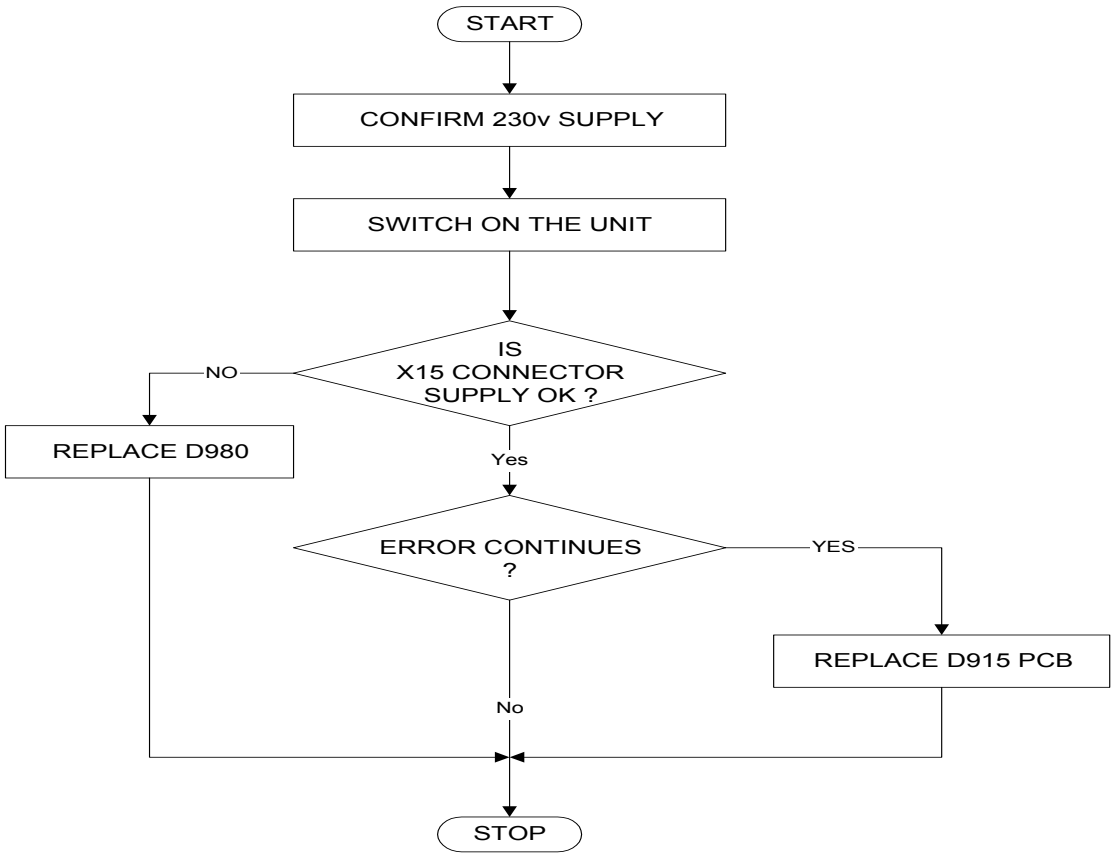
REPLACE J32 FIRMWARE

4.4.2 Code 96 (KV SOLL FAILURE)

ADJUST PRESET P7 ON D915

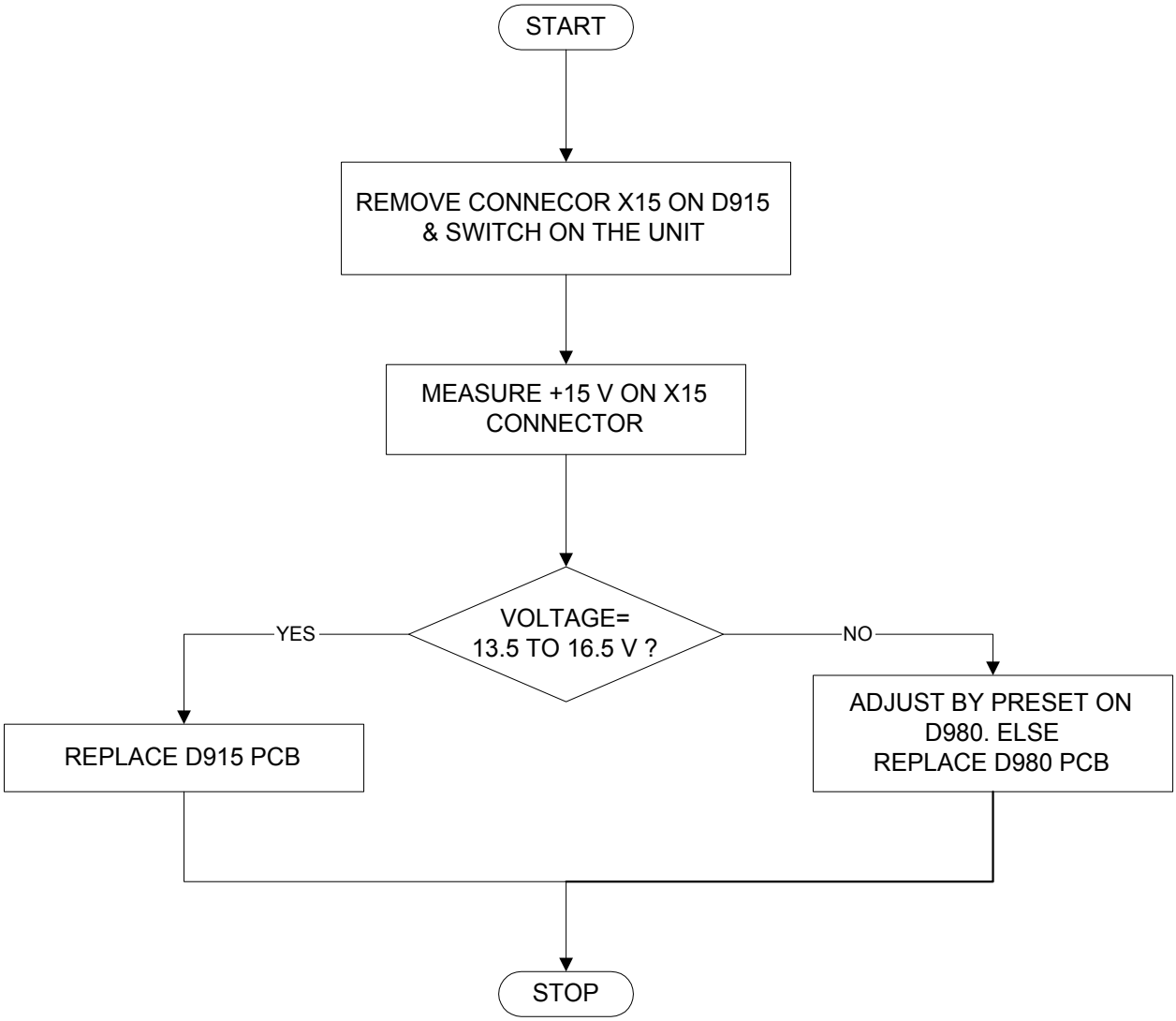
4.4.3 Code 97 (mA FAILURE)

ADJUST PRESET P6 ON D915

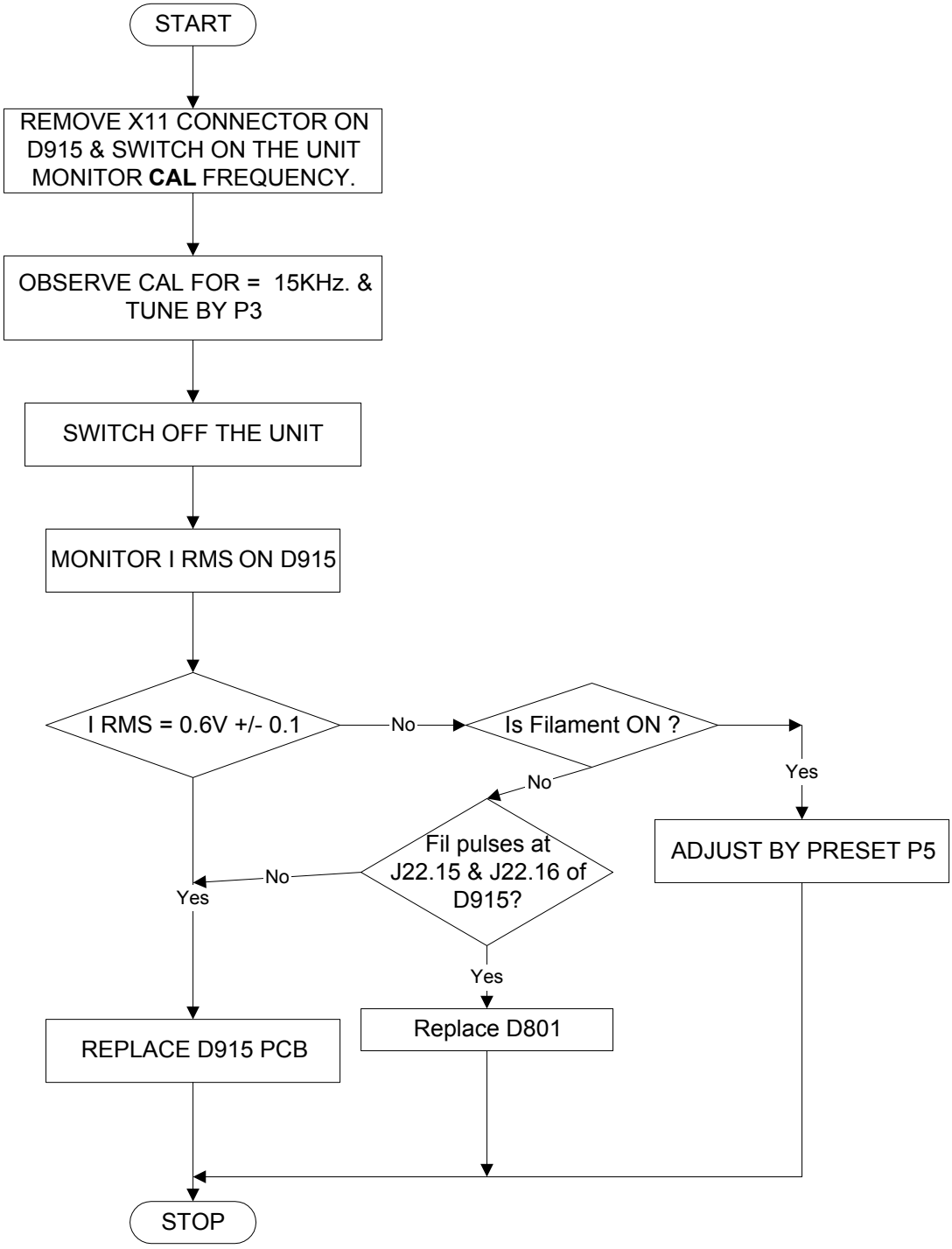


4.5 Standby Codes

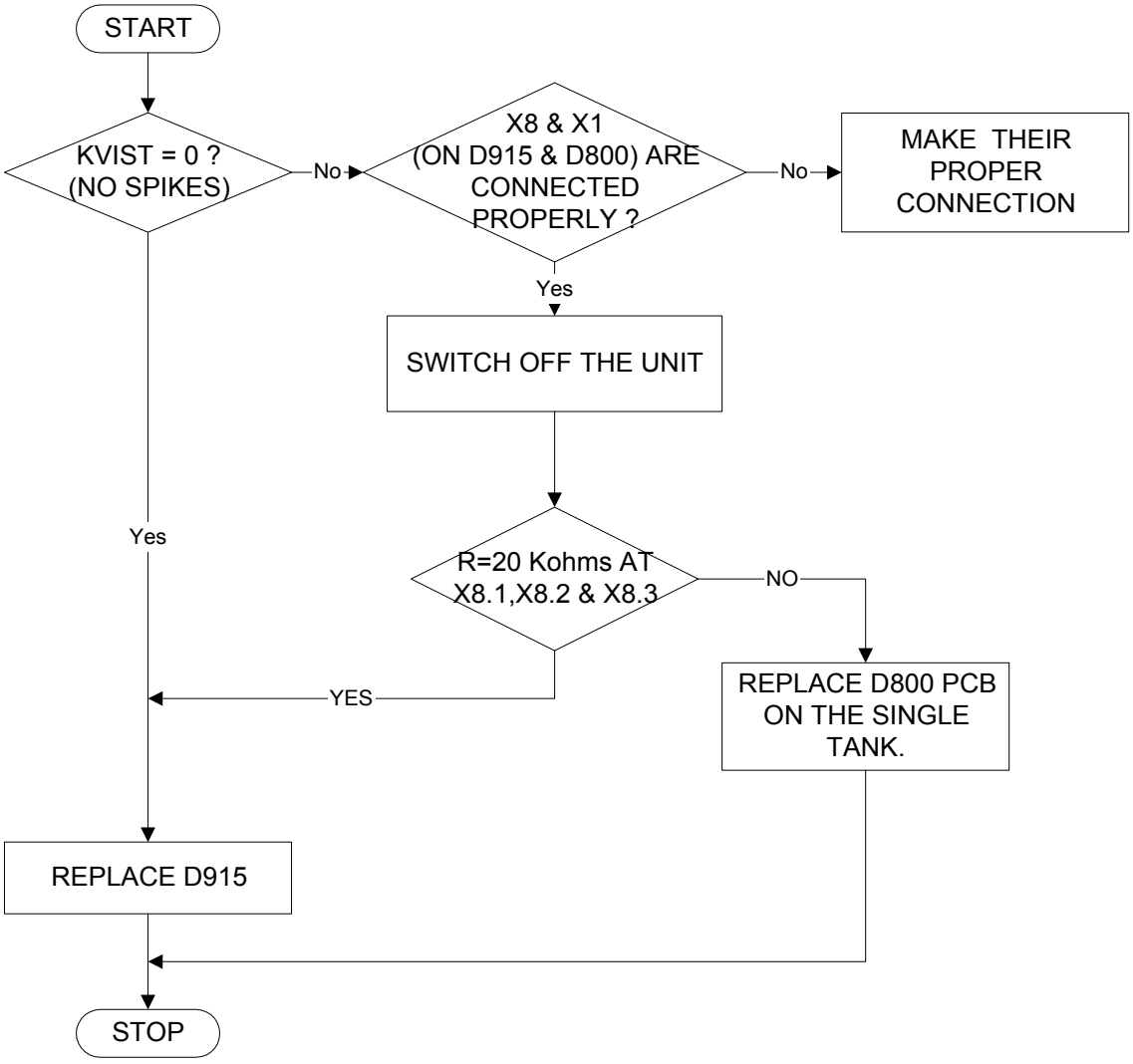
4.5.1 Code 02 : +15 V Supply Code



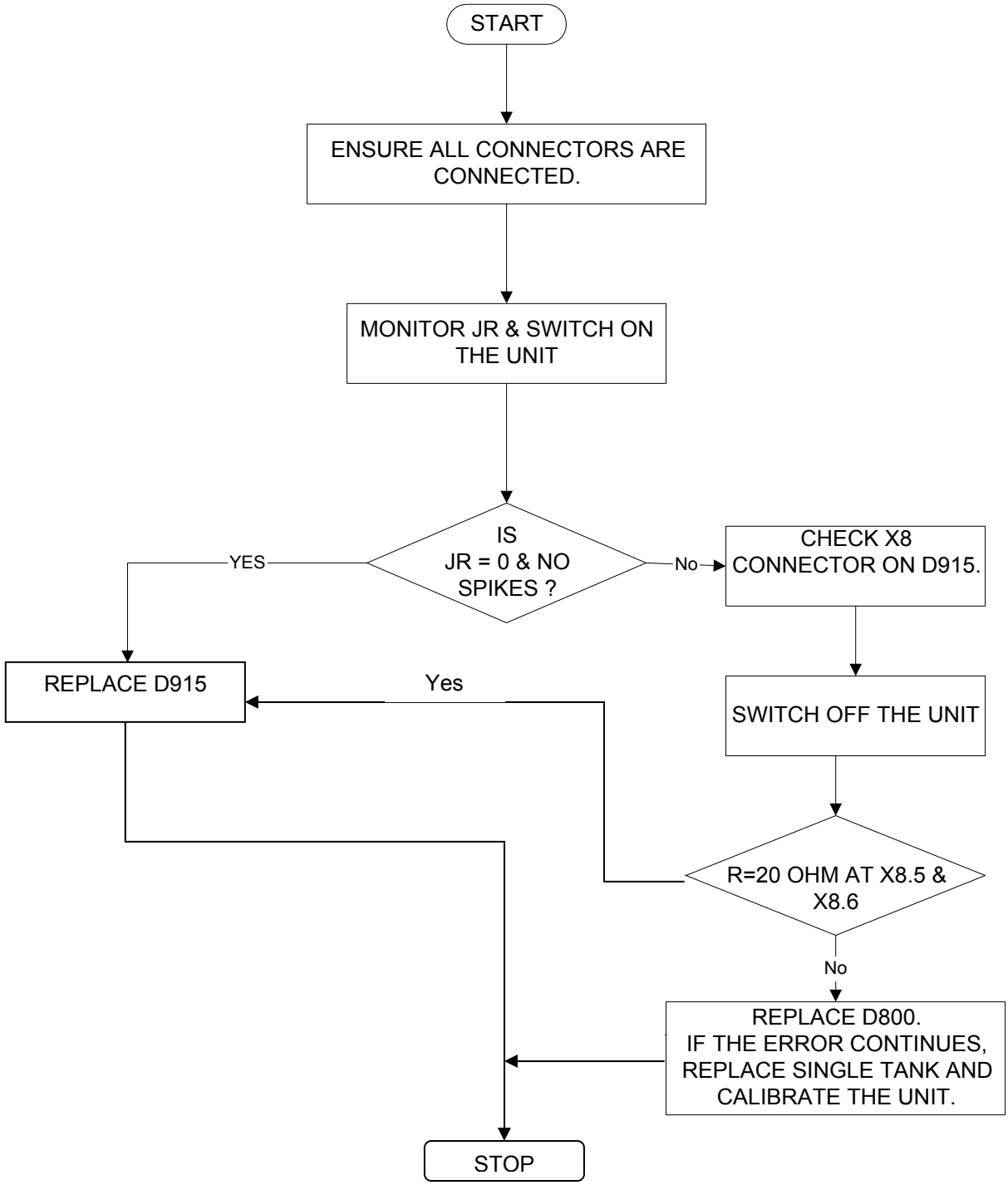
4.5.2 Code 03 & 04 : Iheiz < Istby & Iheiz > Istby



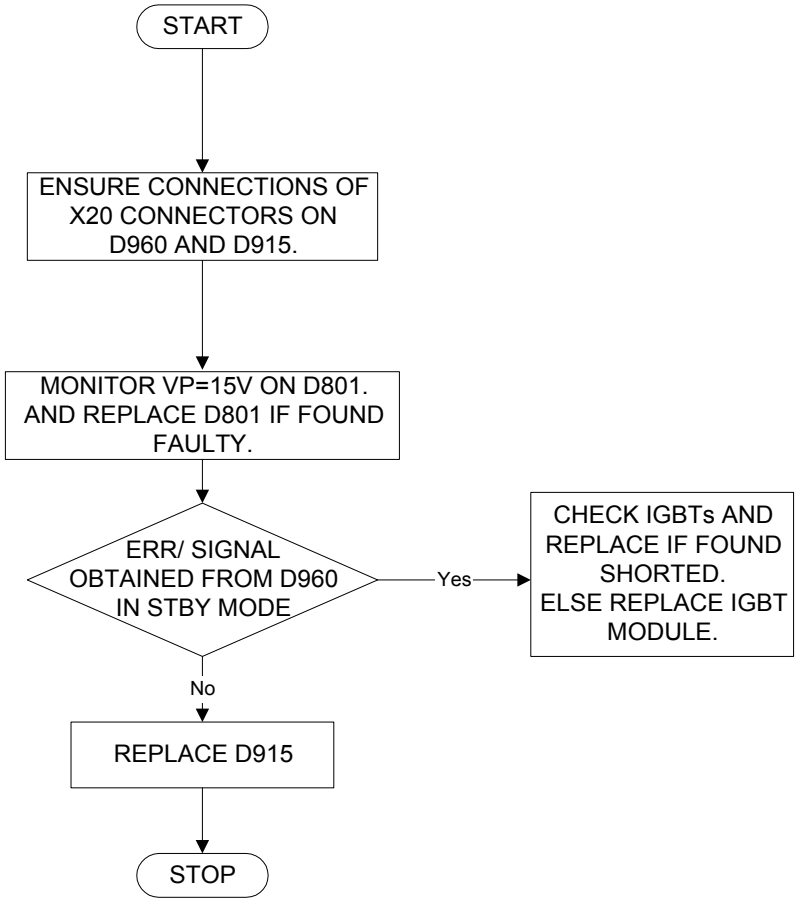
4.5.3 Code 05 : kVist <> 0



4.5.4 Code 06 : JR <> 0

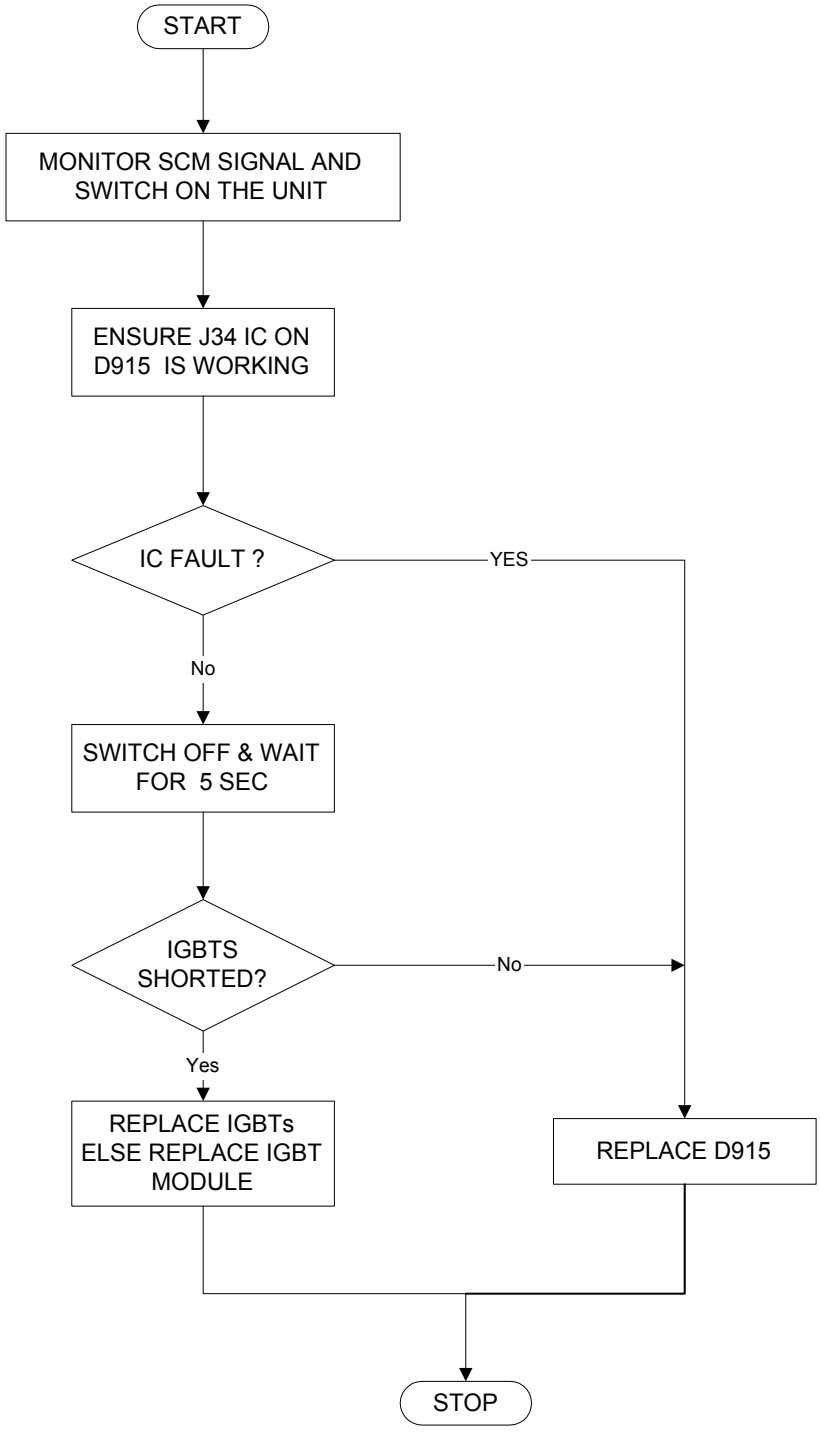


4.5.5 Code 33 : Main Inverter Short Circuit

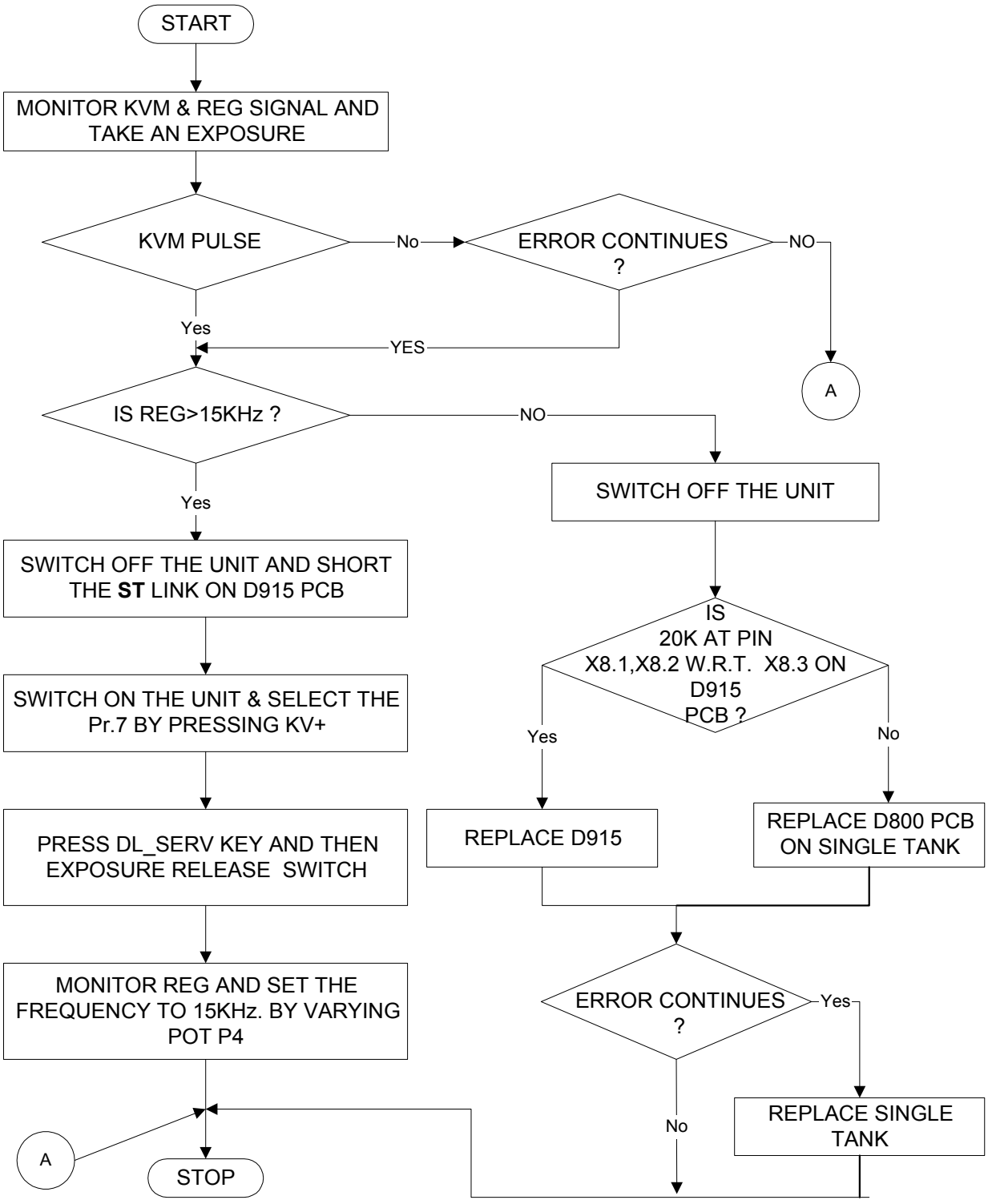


4.6 EXPOSURE CODES

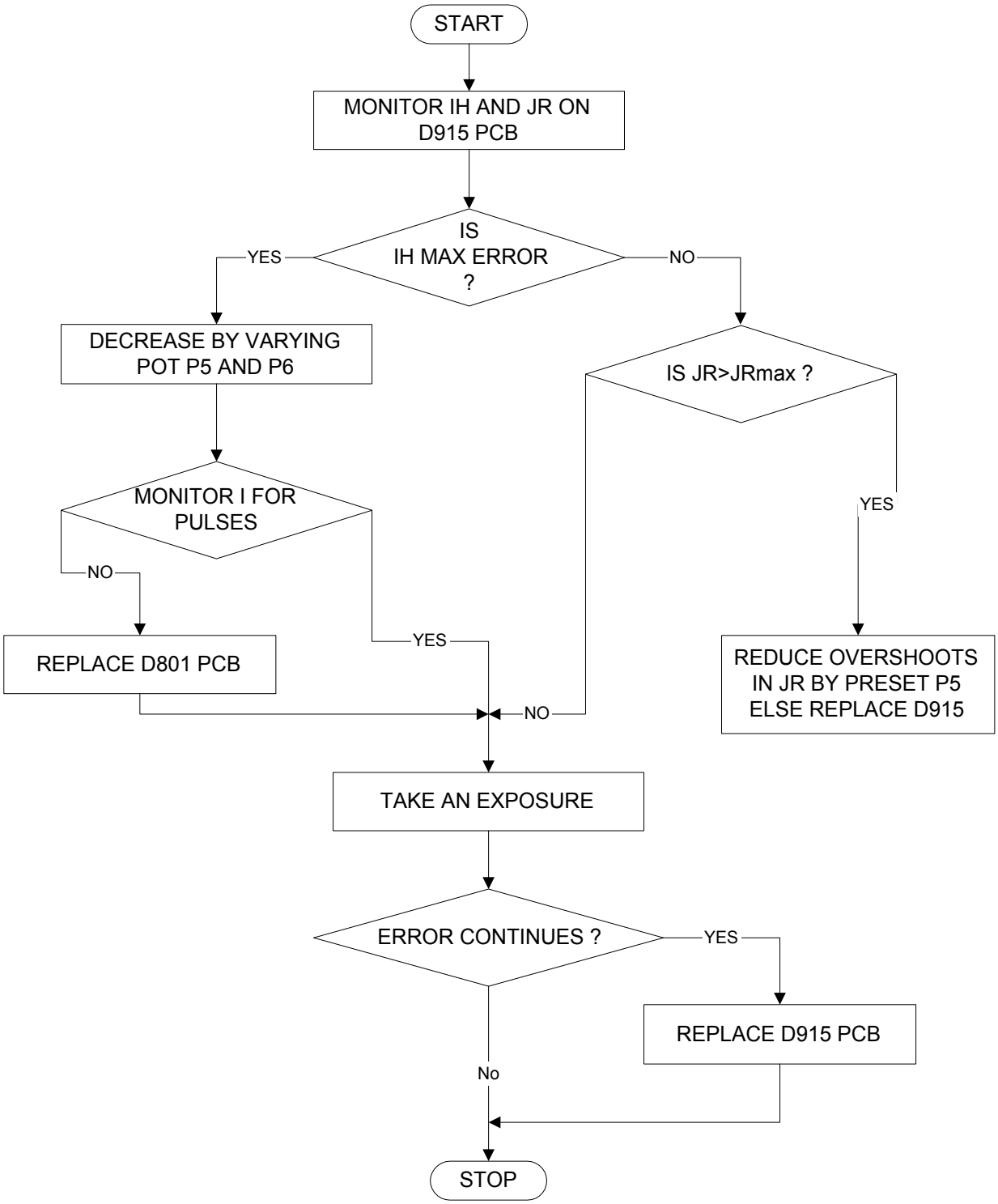
4.6.1 Code 11 : Main Inverter Short Circuit



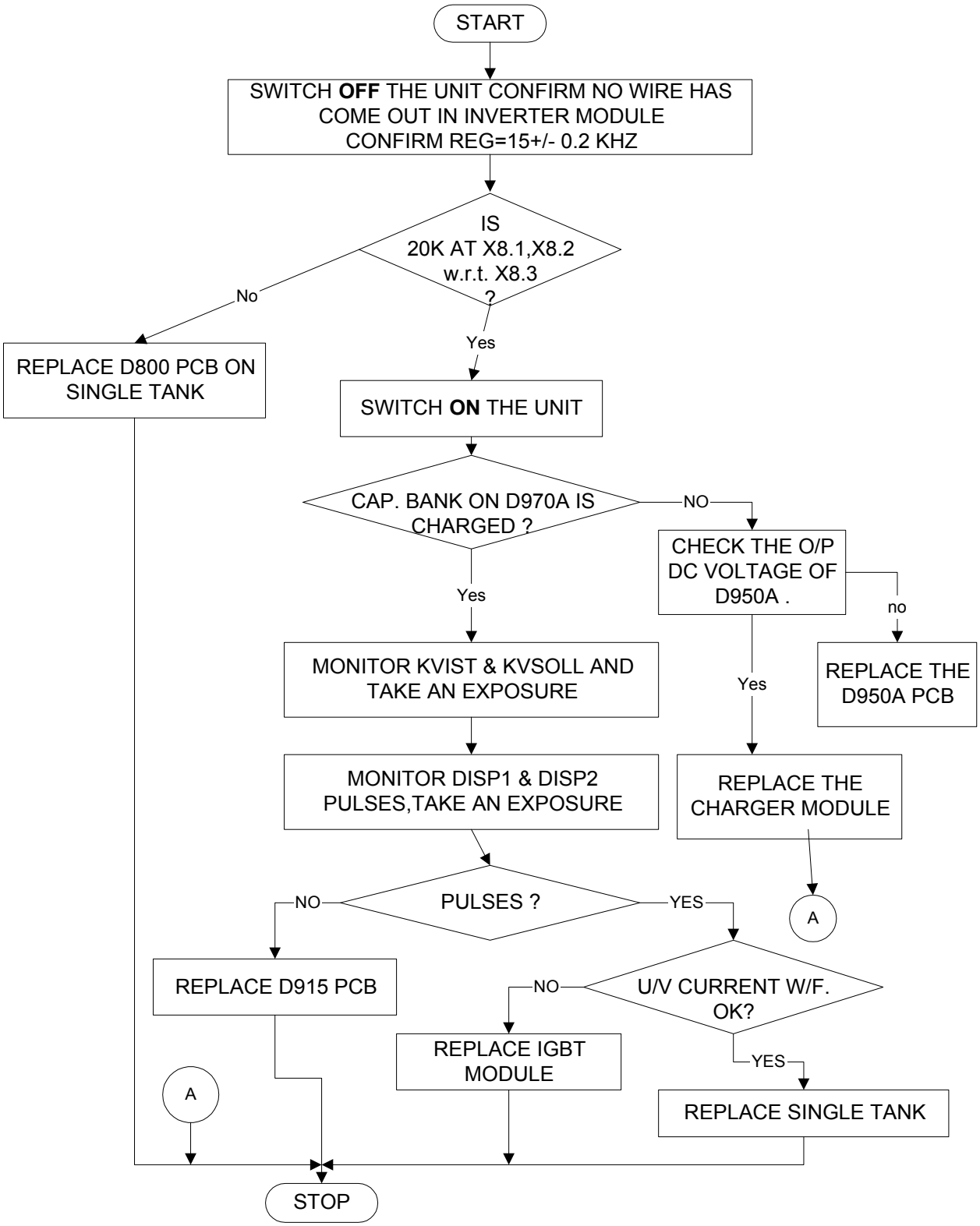
4.6.2 Code 12 : kVist > kVmax



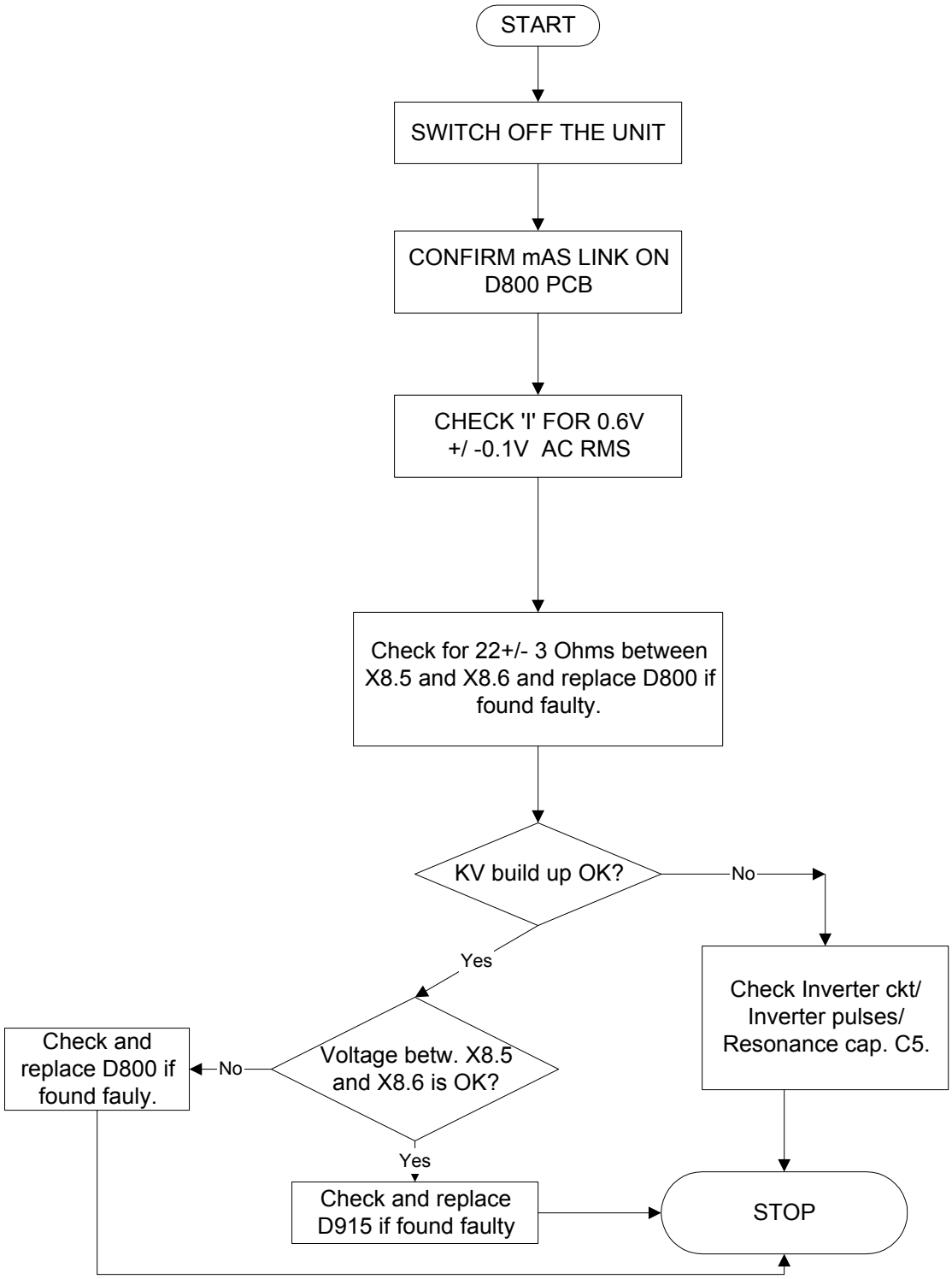
4.6.3 Code 13 : Iheiz > Imax OR JR > Jrmax



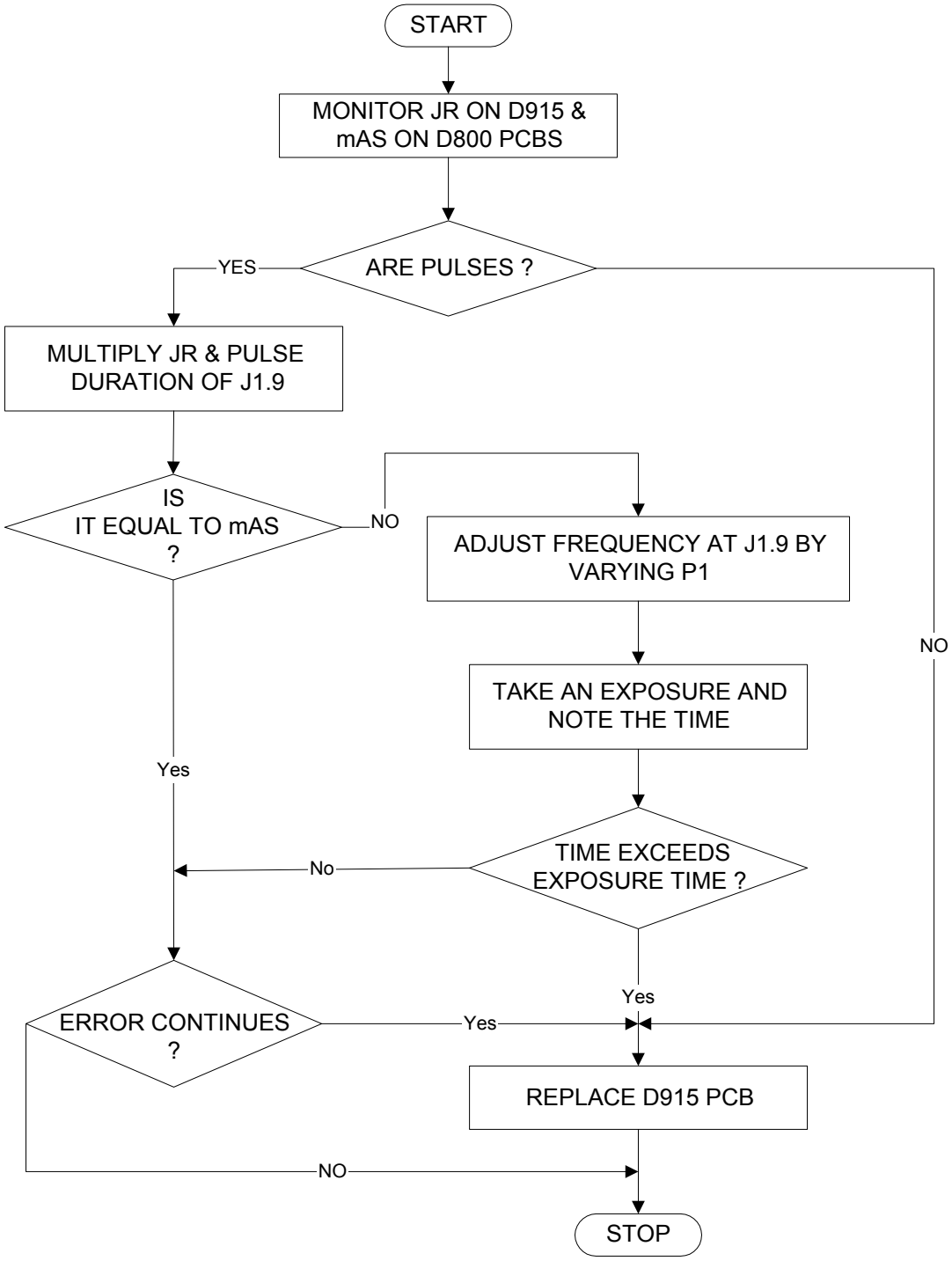
4.6.4 Code 14 : kVist < kVsoll



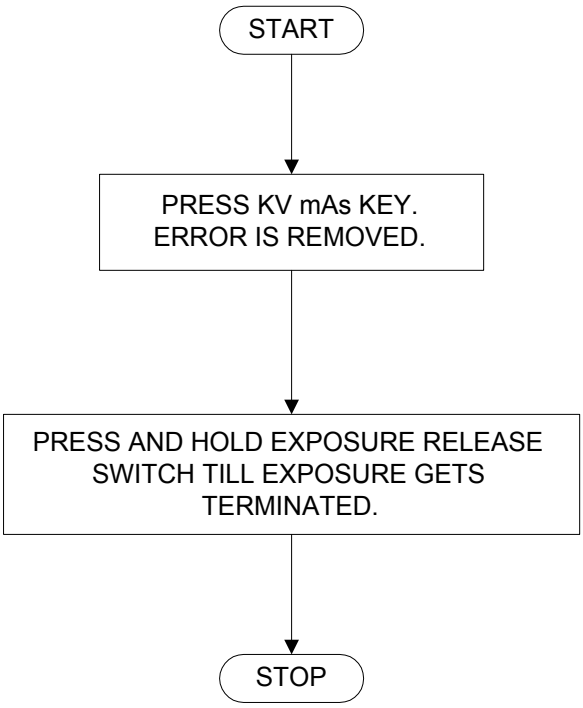
4.6.5 Code 15 : JR < JRS



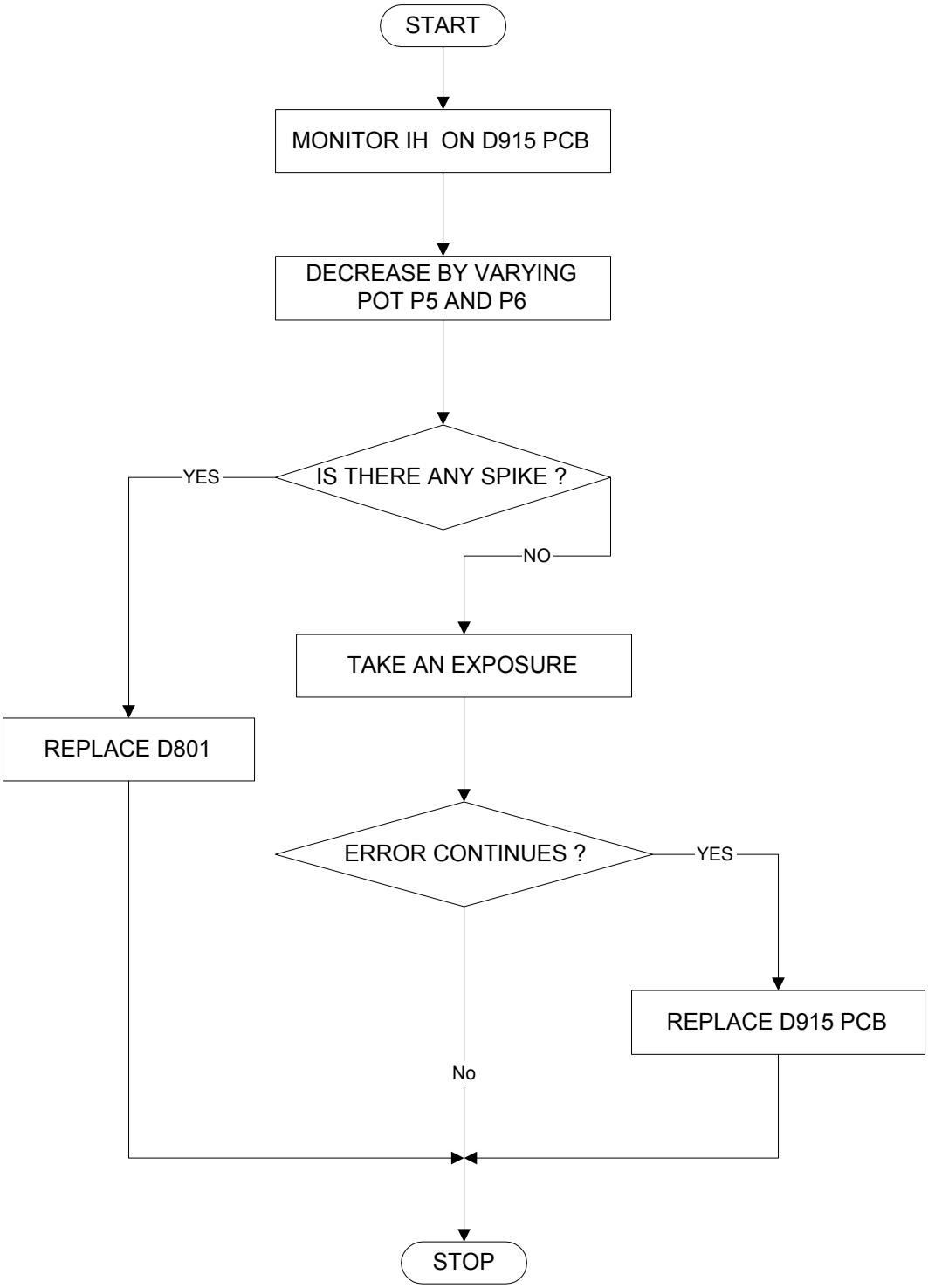
4.6.6 Code 17 : Exposure terminated by Backup Timer



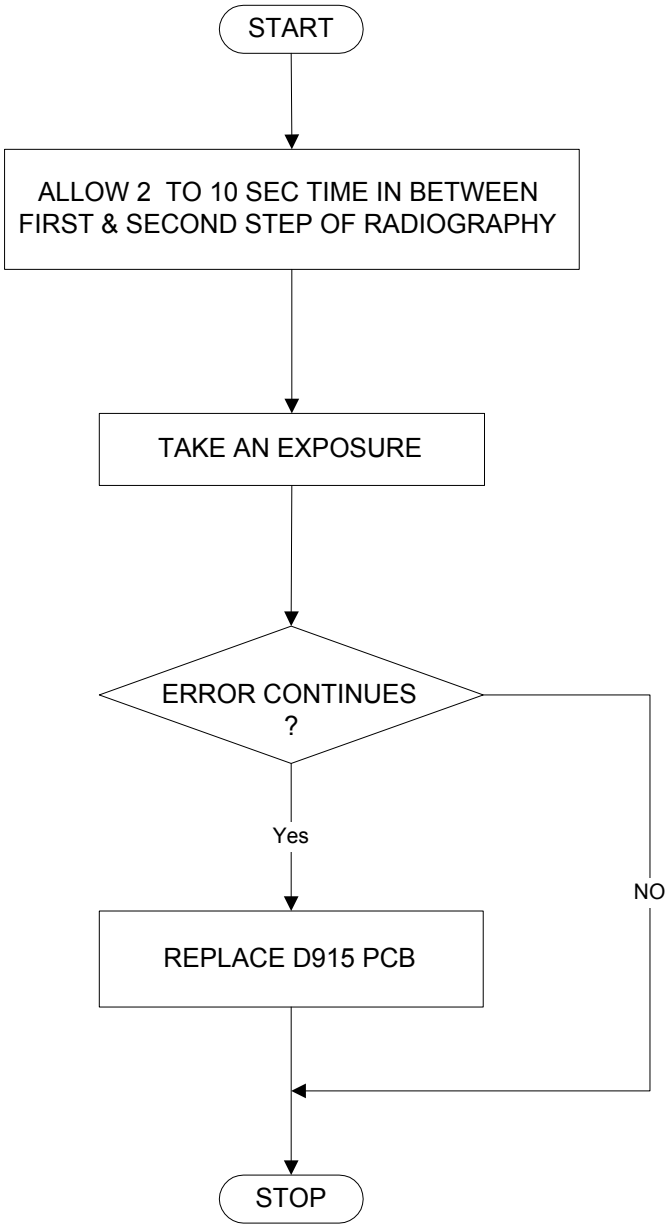
4.6.7 Code 18 : Premature termination of Exposure



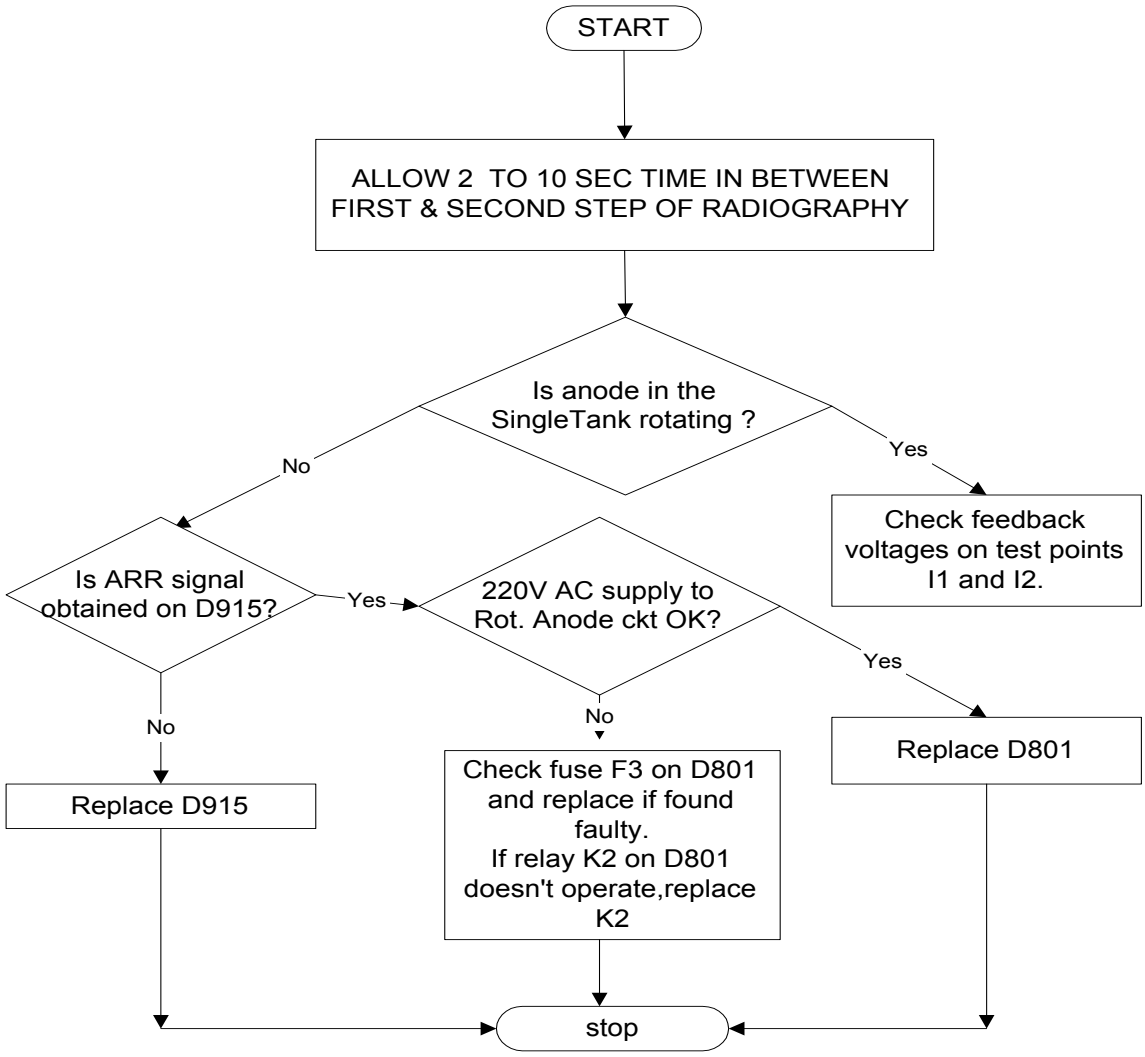
4.6.8 Code 21 : Iheiz > Iheiz maximum



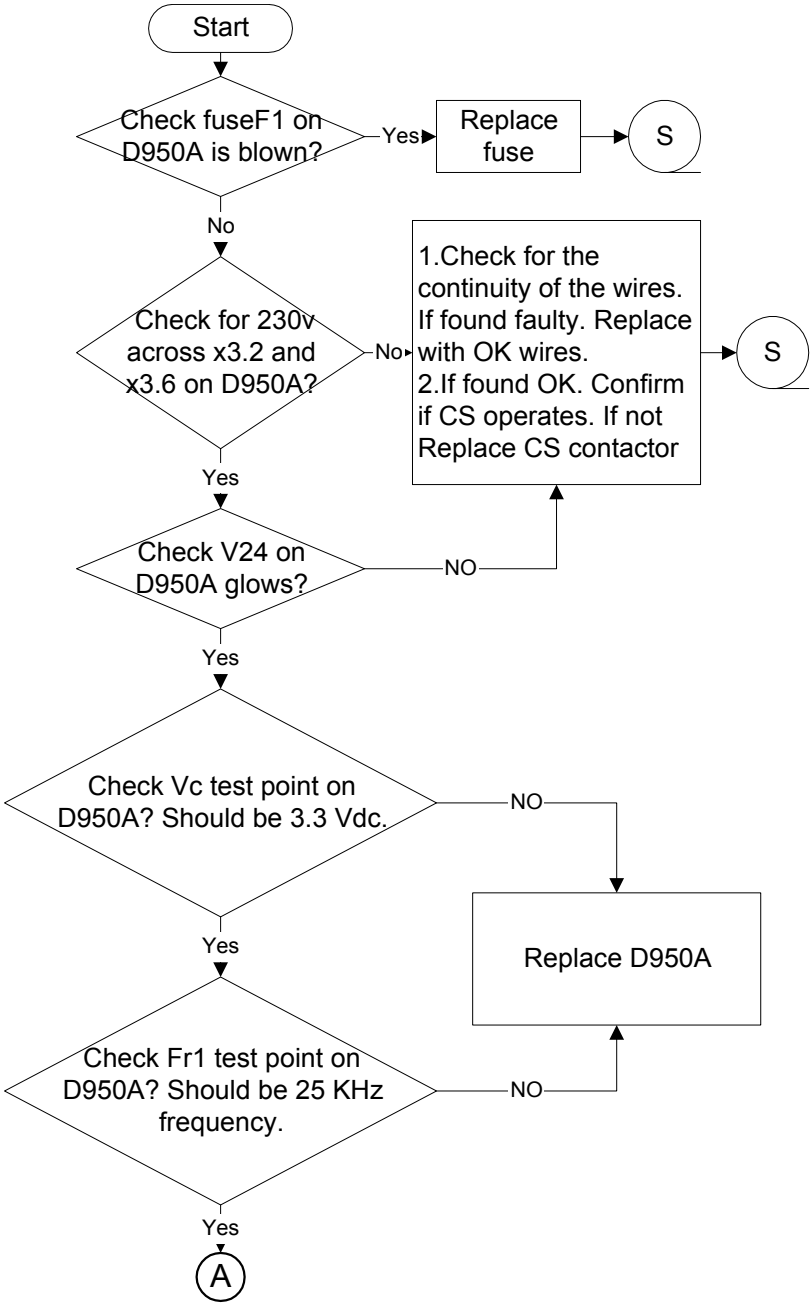
4.6.9 Code 22 : Maximum Preparation Time



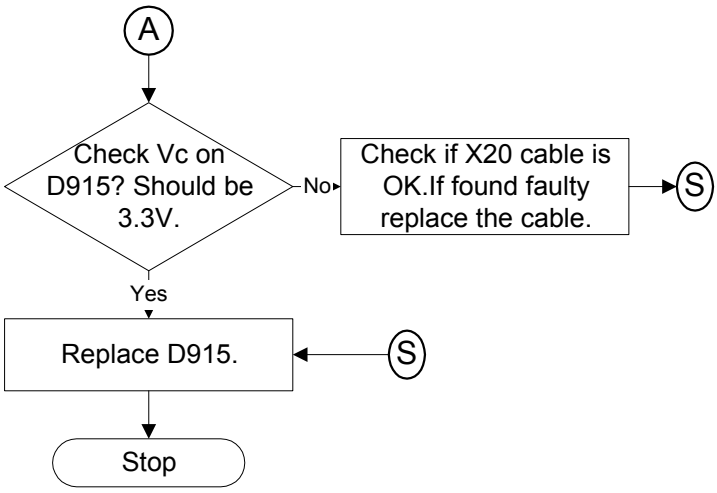
4.6.10 Code 10 : Rotating Anode not OK



4.6.11 Code 31 : No charging



Contd…….


A
Check Vc on D915? Should be 3.3V.
No
Check if X20 cable is OK.If found faulty replace the cable.
S
Yes
Replace D915.
S
Stop

4.6.12 Code 01 : Err signal on D950A active